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ABSTRACT

The departments of mathematics, biology, and chemistry and the teacher education program at the College of Saint Elizabeth (New Jersey) are working in partnership with a public school to improve the teaching of mathematics and science in preschool through high school levels and to recruit minority science and mathematics teachers. The program aims to aggressively recruit 10 to 20 minority women for the teacher education program to pursue science and mathematics majors by targeting high schools throughout the state with promotional materials and by conducting open house sessions for prospective students. The program aims also to retain 80 to 85 percent of these students by linking courses to enrichment groups and by conducting small group sessions guided by professional group leaders who will work with faculty to help students develop study and communication skills, master course content, and build self-esteem and self-confidence. Finally, the program aims to renew the teaching of math and science by employing two outstanding master teachers (one in math and one in science) who will provide specialized teacher training in 2-hour seminars each semester, by collaborating with selected public schools with which the college has established partnerships, and by faculty collaboration at the college for the improvement of the teaching learning process on campus. In the first year of implementation 10 students were recruited for the program. (JB)

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THREE R'S TOWARD EFFECTIVE TEACHING OF MATHEMATICS AND SCIENCE: RECRUIT, RETAIN, AND RENEW

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Presentation at Sixth National Forum
Association of Independent Liberal Arts Colleges for Teacher Education
"The Future Now: Teacher Education for a Changing World"
November 12-14, 1993
Cheyenne Mountain Conference Resort
Colorado Springs, Colorado

Summary: In partnership with Mathematics, Biology, and Chemistry Departments, a public school, and a teacher education program, this project aims to improve the teaching of mathematics and science in K-12 classes, particularly with underserviced and underrepresented populations of students and teachers.

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3 R'S PRESENTATION

Hoffman-LaRoche, Inc., through its TEEMS (Teaching Excellence and Equity in Math and Science) initiative, granted the College of Saint Elizabeth $147,000 in support of a project we call "Three R's Toward the Effective Teaching of Mathematics and Science: Recruit, Retain, and Renew".

Rationale. The College of Saint Elizabeth has a long-standing reputation for the excellence of its teacher education program and its majors in biology, chemistry, and mathematics. The departments offering these programs have strong faculty members and curricula as well as state-of-the-art facilities. The faculty members in these areas have always collaborated for preparing students as elementary and high school teachers of mathematics and science. Working in teams, they have also given numerous inservice programs over the past twenty years in the teaching of science and math to elementary school teachers, including those in schools with a high level (over 90%) of minority enrollment.

The national concern over the lack of interest of college students to pursue a teaching career in science and mathematics, as well as the attrition rates of women and minorities in science and mathematics, is also mirrored at the College of Saint Elizabeth. An analysis of this trend at the College indicates that our students' inability to succeed in college level course work is directly related to inadequate mathematics and science preparation. We suspect that this is a result of the quality of science and mathematics instruction at the elementary and secondary levels. We believe this situation is a result of several factors which include: (a) a lack of interest and preparation on the part of pre-college students and pre-service teachers to pursue excellence in the teaching of

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mathematics and science; (b) a lack of support and encouragement for undergraduates that promotes content mastery in mathematics and science; and (c) a lack of sequential and developmental personal support that equips undergraduates to address ways of removing the barriers to success in mathematics and science, particularly among student groups underrepresented or underserviced.

In past decades significant numbers of students pursued majors in mathematics and science, coupled with the teacher education program, at the College of Saint Elizabeth. Over the past several years, however, pre-service teachers enrolling in the College's teacher education programs are not choosing to major in mathematics or science. College data demonstrate that in the past five years only 7% (11 out of 150) student teacher graduates completed their programs as mathematics and science majors. This downward shift is unacceptable at the College of Saint Elizabeth where we currently have superior resources, i.e., faculty, curricula, and facilities, to make a significant contribution to the preparation of elementary school teachers who are specialists in the fields of math and science. Consequently, the College of Saint Elizabeth is prepared to make a serious commitment to encourage and support the development of competence, confidence, and content in the teaching of math and science. Specifically, the project has three objectives:

(a) aggressively recruit 10, 15, and 20 minority women for 1993, 1994, and 1995 respectively for our teacher education programs who will pursue science and mathematics majors. We plan to do this by:
-targeting high schools throughout the state with a promotional brochure, a poster, and a video tape.
-conducting open house sessions for prospective students to introduce them to our faculty, students, and facilities.

(b) retain 80-85% of these students by
-linking courses to enrichment groups.
-conduct small group sessions guided by professional group leaders
who will work closely with the faculty to help students develop study and communication skills, master course content, and build
self-esteem and self-confidence.
and

(c) renew the teaching of math and science by:
-employing two outstanding master teachers, one in math and one in science, who will provide specialized teacher training in two- hour seminars each semester.
-collaborating with selected public schools with which we already have established partnerships. Mentors in these schools will work one-on-one with our students during field work for various courses and serve as cooperating teachers.
-faculty collaboration at the College for the improvement of the
teaching learning process on our campus.

Objectives and Assessment: Our first objective is based on the belief that we can attract a greater number of students, particularly minorities, to the College who are interested in a combination of math/science/teacher education. We base this premise on the fact that the two areas in which our prospective students indicate the greatest interest are biology and teacher education, although not necessarily in combination with each other.

Our second objective focuses on retaining majors in math and science by providing an intensive support system. We have used this system, based on a model created at the University of California at Berkeley, with amazing results in our Hispanic Leadership Program which boasts of an unparalleled 85-90% persistence rate to graduation. Briefly described, the approach uses small group study sessions led by a professional tutor, to enable students to master course content, develop study and communication skills, and build self esteem in pursuing a rigorous program of study. Every course in biology, chemistry, and math that a major takes during her freshman and

sophomore years, is paired with a particular study group. The group leader and faculty member teaching the course work together in identifying the course material to be stressed. The faculty members will develop and utilize innovative teaching techniques and instructional materials which will more actively involve students in the classroom and engage them in more stimulating course assignments. In addition, they will prepare a study guide for each course which will assist students in the mastery of course content and new vocabulary, particularly in the sciences.

In accomplishing the third objective, we will use professional educators in math and science as "Master Teachers" to assist our students in the teacher education program in becoming excellent teachers. Two Master Teachers, one in science and one in math, who themselves are recognized for excellence in teaching, will each give a two hour seminar every semester to provide specialized teacher training. The Master Teachers will meet each semester with students to discuss and demonstrate teaching strategies which they have found particularly helpful.

In addition, we will collaborate with selected public elementary schools with which we already have established partnerships for the advancement of science and math teaching. Most notable among these is Public School #9 in Paterson, NJ, where the College faculty in science and math have been working with the elementary school teacher in the past. "Mentors" in these schools will be assigned to the College of Saint Elizabeth students one-on-one during the students' years of pre-service training. The mentor, in her/his role of cooperating teacher, will help the students put into practice the methods and strategies they have developed.

Beyond this, the Master Teachers will hold an annual Professional Seminar for the mentors, College Faculty, and students involved in the project, which will focus on recent innovations in teaching strategies and instructional materials.

As the program progresses, we will engage in ongoing assessment of our progress by:
-reviewing admission data to monitor recruitment.
-reviewing enrollment statistics to determine if we are reaching our goal of 80 percent retention.
-evaluating courses and programs. Students, instructors, and mentors will be asked to complete evaluation forms which encourage them to reflect on the content and methods in their courses, special programs, and enrichment groups.
-collaborating with an advisory board composed of educators concerned with the teaching of math and science.

Progress Report: Many individuals have been working on various aspects of the grant. The project Director, responsible for overseeing the implementation of the grant, has collaborated with faculty in the math, biology, and chemistry departments. These faculty have developed supplemental materials for the study groups, have hired group leaders, and have scheduled the group sessions.

Two Master Teachers are hired from local public schools, one in science and one in math, to run special seminars each semester for our students and to consult with our faculty. They have planned the content of the seminars.

We believe it is critical to provide an urban experience for students; they will spend their field experiences at our cooperating school, P.S. #9, the Charles Reilly School in Paterson, NJ, for observation, microteaching, practicum experiences, and all or part of student teaching. We have received enthusiastic support from the staff of P.S. 9, and they are eager to participate in every aspect of the program.

We have appointed a grant advisory board, composed of school and college educators, who provide us with feedback and direction as we implement the goals of the grant.

We have recruited 10 students as projected in the proposal. Recruiting for this phase of the project has been through advisement, since the recruitment materials were not completed during normal admissions office activities. The video tape is completed, as well as the brochures, and poster. Open house activities will take place in the spring semester.

We have made one notable modification in our original proposal. We are experimenting with using peer leaders for our groups rather than professionals exclusively. Research has shown peers to be extremely effective as tutors, and we want to see how this might work with our groups. The Director and two colleagues from the chemistry and biology departments traveled to Xavier

College in New Orleans during the summer months to attend a workshop on their Pathways to the Biomedical Sciences Program. Xavier is the only Afro-American Catholic college in the United States, and they have an amazing track record for getting African-American students into the biomedical graduate programs. They have a recruitment effort that begins in middle school with clubs, summer programs, and regular newsletters and mailings. Xavier tracks these students through high school and into college. If they attend Xavier, they participate in the same kinds of workshops we designed for this grant, and the college relies strictly on peer tutors to lead these groups.

Presently, we have two groups in chemistry, one in math, and one in biology. Currently, peers are leading all but the math group, and we are following the situation to see what develops through midterm evaluation procedures. A winter training session for tutors is being offered to the group leaders funded by the College.

The greatest challenges, offered by this grant, can sometimes provide the greatest rewards. While schedules have made collaboration difficult, the mere fact that we are collaborating with the faculty from the math and science departments has been rewarding. It is quite exciting to experience college professors engaged in inter-disciplinary efforts. This grant has compelled math and science and education faculty to talk together about learning and teaching. And that in itself is no small accomplishment.